

IN THE UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF TENNESSEE
WESTERN DIVISION

TIMOTHY BROWN, both)	
Individually and as Next Friend)	
of his minor daughter Melody)	
Brown and MELODY BROWN,)	
)	
Plaintiffs,)	
)	
v.)	No. 03-2282-JPM/sta
)	
UNITED STATES OF AMERICA)	
)	
Defendant.)	

OPINION AND ORDER FOLLOWING NON-JURY TRIAL

Plaintiffs Melody Brown and her father, Timothy Brown, both individually and as next friend of his minor daughter, bring this suit under the Federal Tort Claims Act, 28 U.S.C. § 2671 et seq. (the "FTCA"), alleging that the United States, acting through the United States Navy staff at the Branch Medical Clinic, Naval Support Activity Mid-South (the "BMC") in Millington, Tennessee, was negligent in failing to provide adequate medical care to the unborn Melody Brown from the time of conception through the twenty-eighth day of gestation. The Court held a bench trial in this case on November 26, 27, and 28, 2007. Plaintiff was represented by Jamal Alsaffar, Esq. and Michael Archuleta, Esq. The government was represented by William W. Siler, Esq. and Harriett M. Halmon, Esq. The

Plaintiffs called the following six witnesses at trial: Cpt. Leland Mills, expert witness Dr. Dan Martin, expert witness Dr. Lawrence Leichtman, expert witness Dr. Robert Voogt, Lt. Cmdr. Deborah Brown, and Plaintiff Timothy Brown. The Defendant called the following four witnesses to testify at trial: Dr. Leland Mills, expert witness Robert Jackson, expert witness Dr. Joseph Bruner, and expert witness Dr. Frank Ling.

I. Trial Testimony

Melody Brown

Plaintiff Melody Brown appeared in Court prior to the parties' opening statements. Melody, now six and a half years old, entered the courtroom using crutches to support her legs and sat in the witness box with the assistance of her father, Timothy Brown. Melody demonstrated her verbal ability and intelligence by answering a few simple questions. Melody told the Court that she likes her school and the zoo and that she dressed as a cat for Halloween.

Cpt. Leland Mills

Both Plaintiffs and Defendant called Cpt. Leland Mills as a witness. Cpt. Mills attended college and medical school in Oklahoma, earning his medical degree in 1978 from the Oklahoma School of Medicine. He completed a three year residency in pediatrics in an Oklahoma City hospital and then joined the Navy. Cpt. Mills served as a flight surgeon for almost twenty-

five years at facilities in Pensacola, Florida; Philadelphia, Pennsylvania; Antarctica; Spain; and Millington, Tennessee. Cpt. Mills served as the Senior Medical Officer while stationed in Millington. Cpt. Mills testified that in June 2000, he had 1200 patients under his primary care, despite a patient load limit of 1000. Cpt. Mills testified that his load exceeded his limit a majority of his time at the clinic. Cpt. Mills retired to Pensacola, Florida, in February 2006.

At trial, Cpt. Mills testified that he did not recognize Lt. Cmdr. Brown when he saw her at his deposition, but that he does remember his appointment with her on June 16, 2000. Cpt. Mills testified that, because she intended to become pregnant, Lt. Cmdr. Brown was prenatal at the time of her appointments with him. Lt. Cmdr. Brown had already seen Lt. Mukherjee and followed his directions to begin taking prenatal vitamins, stop taking migraine medication, have a pelvic ultrasound, and schedule a pelvic exam.

According to Cpt. Mills, Lt. Cmdr. Brown's June 16, 2000, exam was the full and comprehensive general exam administered every five years. During this general exam, Lt. Cmdr. Brown informed Cpt. Mills of her prenatal status. Lt. Cmdr. Brown's prenatal vitamins were listed as her only medication on June 16, 2000. During the appointment Cpt. Mills discussed the side effects of prenatal vitamins with Lt. Cmdr. Brown. Cpt. Mills

testified that in medical school he learned that it is not necessary for a person with normal blood levels of iron to take additional iron and that a person who does so for an extended period of time may suffer from hemosiderosis. Cpt. Mills remembered conveying this possible concern to Lt. Cmdr. Brown after she inquired about side effects associated with prenatal vitamins.

Cpt. Mills testified that he did not recommend Lt. Cmdr. Brown stop taking her prenatal vitamins. Had he done so, he testified, that recommendation would have been noted in her medical records from that day. Cpt. Mills also testified that if he had believed Lt. Mukherjee's prescription was in error, he would first have discussed the issue with Lt. Mukherjee before recommending a different course of medication.

On June 16, 2000, in addition to discussing the possible risks associated with prenatal supplements, Cpt. Mills also referred Lt. Cmdr. Brown to the petty officer in charge of immunization screenings. The petty officer administered a typhoid vaccine, which Cpt. Mills agreed is generally not recommended for pregnant women, to Lt. Cmdr. Brown. Cpt. Mills did not have any recollection of the referral or the vaccine and was "surprised" to learn of it during his deposition. At trial Cpt. Mills testified that "in an ideal situation" he would have

noted that Lt. Cmdr. Brown was trying to get pregnant in his referral.

Cpt. Mills testified that he has no personal recollection of Lt. Cmdr. Brown's follow-up visit six days later on June 22, 2000, but that the medical records indicate that on that day Lt. Cmdr. Brown was no longer taking prenatal vitamins but still planning a pregnancy. The medical records also indicated that Cpt. Mills did not recommend prenatal vitamins or discuss nutrition or folic acid with Lt. Cmdr. Brown during the appointment on June 22, 2000. Cpt. Mills testified that such topics were inappropriate for a general exam but also conceded that Lt. Cmdr. Brown's stated purpose for her visits was to prepare for her pregnancy. Cpt. Mills testified that it was Lt. Mukherjee's responsibility, not his, to ensure Lt. Cmdr. Brown took prenatal vitamins. Cpt. Mills had Lt. Mukherjee's records from his appointments with Lt. Cmdr. Brown when he saw her in June 2000. Those records did not include any prenatal counseling, family history, or folate supplementation information. Cpt. Mills testified that he "didn't look closely enough" at Lt. Cmdr. Brown's medical records and "didn't recognize it as her having stopped" taking prenatal vitamins. Cpt. Mills characterized this as an "unfortunate oversight" on his part.

Cpt. Mills testified that Lt. Cmdr. Brown did not suffer from diabetes or high core temperatures during her pregnancy, did not have a genetic syndrome predisposing her to conceive a child with spina bifida, and she did not take anti-convulsant medications during her pregnancy. Given these conditions, Cpt. Mills testified that Lt. Cmdr. Brown's only risk factor for spina bifida was a lack of folic acid during pregnancy.

Cpt. Mills testified that he first heard about Lt. Cmdr. Brown's complaint against him from Lt. Cmdr. Pratt. When Lt. Cmdr. Pratt brought the complaint to his attention, Cpt. Mills reviewed the records from the June 16, 2000, appointment, but not the June 22, 2000, appointment, a circumstance he believed explained why he remembered the former but not the latter. Cpt. Mills took the complaint very seriously because, he said, "this doesn't happen to me." Mills understood the complaint implicated his care and was adversarial in nature. He had no recollection of any telephone call from the Browns regarding his treatment or their baby's development.

Dr. Dan Martin

Plaintiffs' second witness, Dr. Dan Martin, was admitted as a medical expert regarding the community standard of care, whether Cpt. Mills violated that standard, and whether such violation caused Melody Brown's spina bifida. Dr. Martin, a board certified reproductive endocrinologist since 1979,

currently practices medicine at the University of Tennessee Medical Group. Dr. Martin received his undergraduate and medical degrees from Emory University. Dr. Martin completed his internship and residency in obstetrics and gynecology and his fellowship in reproductive endocrinology at Johns Hopkins University.

At trial Dr. Martin explained the defective embryonic development which results in spina bifida. Dr. Martin testified that around the eighteenth day of gestation fetal cells develop "sidedness," that is they begin to identify with one side of the body or the other. Between the twenty-first and twenty-eighth days of gestation the cells on the right and left side of the developing spinal chord form a neural canal which cradles the chord. Twenty-eight days after fertilization this canal should close to create a neural tube, which surrounds and protects the chord within it. Dr. Martin described this process as functioning like a zipper. Spina bifida occurs when the two sides of the neural canal fail to fully seal and form an unbroken neural tube. Dr. Martin described this defect as resembling a zipper that has skipped a tooth, leaving openings where the zipper should have closed.

Dr. Martin explained how in Melody Brown's case the spinal chord was not just exposed by these openings, but developed partially outside the neural tube. This condition, called a

Type II Chiari malformation, prevents the chord from growing with the rest of the body and pulls the brain down against the base of the skull as the chord stretches. This pressure resulted in Melody's hydrocephalus, an inflammation of the brain and blockage of the flow of spinal fluid out of the skull.

Dr. Martin testified that, of all known risk factors for neural tube defects, an inadequate supply of folic acid was the only one applicable to Lt. Cmdr. Brown. Dr. Martin described folic acid as the "predominant factor," because of the "chemical connection" between folic acid and the formation of the neural tube. Dr. Martin testified that an 800 microgram supplement of folic acid per day has been shown to decrease the chance of having a child with spina bifida by 53% to 92%. The United States Food and Drug Administration, recognizing that many women do not know they are pregnant until after the window for neural tube closure has passed, began mandating that wheat flour be fortified with additional folic acid in the 1990s.

Dr. Martin's expert opinion was that it has been the standard of care in the Memphis, Tennessee, medical community to prescribe prenatal vitamins containing folic acid to women planning pregnancy since 1992. Dr. Martin testified that the medical evidence supporting the link between folic acid and spina bifida motivated him, for the "only time in his life," to create and display a poster in his practice informing his

patients of the importance of adequate folic acid intake during pregnancy.

Dr. Martin reviewed Lt. Cmdr. Brown's medical records from her appointments with Cpt. Mills. Dr. Martin's expert opinion was that if Cpt. Mills instructed Lt. Cmdr. Brown to stop taking prenatal vitamins on June 16, 2000, he breached the standard of care. Dr. Martin noted that Lt. Cmdr. Brown was a very compliant patient, consistently following all her doctors' orders. Dr. Martin also gave the expert opinion that, regardless of what Cpt. Mills told Lt. Cmdr. Brown on June 16, 2000, he fell below the standard of care when he failed to restart Lt. Cmdr. Brown on prenatal vitamins on June 22, 2000.

In giving his opinion that Cpt. Mills' breach of the standard of care more likely than not caused Melody Brown's spina bifida, Dr. Martin relied on the neural tube defect risk reduction model promulgated by N.J. Wald, et al., in "Quantifying the Effect of Folic Acid," 358 LANCET 2069 (2001). According to the Wald model, every doubling of the amount of daily folic acid intake cuts the risk of neural tube defect by 50%. Applying the Wald model to Lt. Cmdr. Brown, Dr. Martin assumed a daily folic acid intake of 200 micrograms from food fortification, citing a retrospective study from 2001 by the American College of Gynecologists that concluded that the average American woman received that amount from fortification

each day. On cross-examination, Dr. Martin conceded that he had no knowledge of Lt. Cmdr. Brown's actual diet in 2000. Dr. Martin also assumed Lt. Cmdr. Brown's background folate level would have been five nanograms per milliliter, which the Wald model assumed as an average. At these levels, Dr. Martin testified, food fortification alone only reduces the risk of neural tube defects by 23%, but an additional 800 microgram supplement (the amount prescribed by Dr. Mukherjee) would reduce the risk by 57%. Dr. Martin's opinion, based on a meta-analysis¹ of other scientific literature besides the Wald model, was that the risk reduction for Lt. Cmdr. Brown had she continued the multi-vitamin would have been even higher, as much as 60% to 70%, because population studies include the 10% of the population with genetic risk factors, who would be less likely to benefit from folic acid supplementation.

Dr. Lawrence Leichtman

Plaintiffs' second expert witness, Dr. Lawrence Leichtman, testified as to the probability that Lt. Cmdr. Brown's inadequate folic acid intake caused Melody Brown's spina bifida

¹ Meta-analysis is a statistical technique for combining the findings from independent studies on related research hypotheses. Meta-analysis is often used to assess the clinical effectiveness of healthcare interventions. Some folic acid studies have been limited to those with genetic predispositions for spina bifida or to those in a specific geographic area, while others have been general population studies but of greater or lesser size. A meta-analysis can produce a statistically reliable summary of these different studies. Dr. Martin relied on the 2002 March of Dimes meta-analysis, which produced the "summary impression" that a daily dose of 400 micrograms decreased the incidence of neural tube defects by 70%.

and as to Melody Brown's condition and ability to care for herself now and in the future. Dr. Leichtman is a board certified clinical geneticist and pediatrician from Virginia. Dr. Leichtman received his undergraduate and master's degrees from the University of Texas. Dr. Leichtman earned his medical degree from Texas Tech University in 1976 and went on to complete his internship, residency, and fellowship in clinical genetics at Tulsa Medical College at the University of Oklahoma from 1976 to 1981. Dr. Leichtman served in the United States Army from 1969 until 1992, when he was honorably discharged as a Lieutenant Colonel.

Dr. Leichtman's expert opinion at trial was that Lt. Cmdr. Brown's inadequate folic acid intake caused Melody Brown's spina bifida within a reasonable degree of medical certainty. Dr. Leichtman clarified that the time frame in which neural tube defects develop is a matter of a few hours during the third or fourth week of gestation. Even if Lt. Cmdr. Brown received adequate folic acid supplements half way through the fourth week of her pregnancy, if the neural tube defect already existed, there would be no retroactive improvement.

In his testimony, Dr. Leichtman cited medical literature documenting the causal link between inadequate folic acid and neural tube defects from 1976 to the present. Like Dr. Martin, Dr. Leichtman specifically relied on the Wald model in opining

that the folic acid intake Lt. Mukherjee prescribed would have reduced the risk of spina bifida by 57%. Like Dr. Martin, Dr. Leichtman testified that although Lt. Cmdr. Brown's exact risk reduction was unknown, it was probably higher than the 57% cited because the Wald model include participants with genetic conditions that render them less responsive to folic acid supplementation.

In preparation for his trial testimony, Dr. Leichtman examined Melody Brown for a few hours. Dr. Leichtman testified that Melody has a repaired L4-L5 seal, a Type II Chiari malformation, a ventriculoperitoneal shunt placement, hydrocephalus, weakness in her lower extremities, sensory deficits including bowel and bladder dysfunction, and a latex allergy. Based on this meeting and a review of Melody's psychological records, Dr. Leichtman also observed in Melody a lesser ability to deal with frustration than the average six year old. It was Dr. Leichtman's expert testimony that all Melody's conditions were the result of her spina bifida and, therefore, were 57% preventable. Dr. Leichtman explained a number of these conditions' implications for Melody's future health.

When Melody was born, part of her spinal chord protruded outside the protection of her skin between her fourth and fifth lumbar vertebrae. This opening in her back was surgically

closed in the first days of Melody's life. She has a scar from the surgery but no continuing medical needs related to the surgery or the L4-L5 lesion. This protrusion caused Melody Brown's Type II Chiari malformation and her hydrocephalus. Melody Brown received a ventriculoperitoneal shunt placement to relieve the pressure on her brain, but the hydrocephalus seriously impacted Melody's development before she was born and the shunt could be inserted. Dr. Leichtman testified that the hydrocephalus does not affect Melody's upper extremities, but is responsible for the diminished sensitivity in her lower extremities. Melody suffers from a neurogenic bladder because of this decreased sensitivity. As a result, she wears a diaper and requires catheterization four times per day. This condition is permanent. Currently Melody's parents perform her catheterizations. At trial, Dr. Leichtman's expert opinion was that Melody would never learn to self-catheterize. Melody also suffers from bowel dysfunction, which Dr. Leichtman testified will worsen over time.

In addition to the neurogenic bladder and bowel dysfunction, the hydrocephalus also impacts Melody's lower limb strength and sensitivity. Dr. Leichtman testified that, although Melody can walk now with the assistance of crutches, most people in her condition will begin using a wheelchair during high school, when carrying books and climbing stairs make

crutches unmanageable. Dr. Leichtman's expert opinion was that it was "almost certain" that Melody would be in a wheelchair as a young adult and for the rest of her life.

Lt. Cmdr. Deborah Brown

Lt. Cmdr. Deborah Brown, Plaintiff Melody Brown's mother and Plaintiff Timothy Brown's wife, testified next at trial. Born in Minneapolis, Minnesota, and raised in Jacksonville, Florida, in a military family, Lt. Cmdr. Brown chose to serve in the United States Navy. After eighteen years in eight different locations, Lt. Cmdr. Brown is two years away from her planned retirement from the Navy. She and her family plan to remain in the Memphis, Tennessee, area after her retirement.

Lt. Cmdr. Brown testified that she met her future husband, Timothy Brown, in December 1988, and that they married nearly eleven years later in November 1999. Once they were married the Browns began planning a family. Lt. Cmdr. Brown testified that she approached her first pregnancy "carefully." Before she began trying to get pregnant, Lt. Cmdr. Brown called the BMC requesting pre-conception counseling. Lt. Cmdr. Brown testified that the BMC does not permit patients to choose their doctor. The BMC scheduled an appointment with Lt. Mukherjee for April 17, 2000. Lt. Cmdr. Brown remembered asking Lt. Mukherjee about seeing an obstetrician. At the time of her appointment with Lt. Mukherjee, Lt. Cmdr. Brown was thirty-five years old, "so [she]

thought it would be good to see someone in that field. [Lt. Mukherjee] said it wasn't necessary." Lt. Mukherjee did not tell Lt. Cmdr. Brown about the pre-conception counseling office down the hall or that Lt. Elter was on staff there to assist naval personnel with family planning. Instead, Lt. Mukherjee prescribed prenatal vitamins, recommended a pelvic ultrasound, and instructed Lt. Cmdr. Brown to wean off her prescription of Propanalol, a blood pressure regulator Lt. Cmdr. Brown took for her migraines. Lt. Cmdr. Brown testified that she filled the prenatal vitamin prescription and began taking the pills every day within a few days of the appointment. Lt. Cmdr. Brown remembered returning to the BMC about one week after the appointment for a pelvic ultrasound. Lt. Cmdr. Brown testified that she gradually reduced her Propanalol dosage in the weeks following her appointment with Lt. Mukherjee until she was off them completely about three weeks later.

Lt. Cmdr. Brown testified that the earliest available appointment for the physical exams Lt. Mukherjee recommended was June 16, 2000, with Cpt. Mills. Again, Lt. Cmdr. Brown did not choose to see Cpt. Mills but was assigned to him by the BMC. Upon arriving at the BMC for her appointment, Lt. Cmdr. Brown was happy to learn that Cpt. Mills was the Senior Medical Officer there.

Lt. Cmdr. Brown remembered filling out the medical history form for her appointment with Cpt. Mills. At trial, Lt. Cmdr. Brown testified that she included the information about her prenatal vitamins and her plans to get pregnant "because I wanted him to have all the information so he could conduct a full exam. I considered this a part of my preparation for pregnancy." After Lt. Cmdr. Brown filled out the medical form, she joined Cpt. Mills in his office. Lt. Cmdr. Brown remembered Cpt. Mills reviewing her medical records at his desk. He noticed that Lt. Cmdr. Brown reported pain in her abdomen to Lt. Mukherjee, and Lt. Cmdr. Brown informed Cpt. Mills that her ultrasound came back negative. Cpt. Mills also noticed that Lt. Cmdr. Brown was trying to get pregnant. At trial Lt. Cmdr. Brown testified that upon learning that she was trying to get pregnant and that Lt. Mukherjee had prescribed prenatal vitamins, Cpt. Mills said, "I strongly recommend you don't take the vitamins" because of the iron in them. Lt. Cmdr. Brown remembered Cpt. Mills' tone as authoritative and forceful on this point. Lt. Cmdr. Brown disputed Cpt. Mills' testimony that she brought up the topic of the vitamins. Following this portion of her appointment, Lt. Cmdr. Brown and Cpt. Mills used an adjoining room for her physical exam. Then she and Cpt. Mills returned to the office, where Cpt. Mills told Lt. Cmdr. Brown that she looked healthy. Again Cpt. Mills strongly

recommended not taking prenatal vitamins, and that recommendation concluded the appointment. Lt. Cmdr. Brown testified she was "100% sure" that Cpt. Mills told her to stop taking prenatal vitamins twice.

Lt. Cmdr. Brown testified that before her appointment with Cpt. Mills she had no concerns about the prenatal vitamins but that she stopped taking them after her appointment on June 16, 2000. Lt. Cmdr. Brown testified that she felt relieved and fortunate at the time because she was not yet pregnant and she believed Cpt. Mills had helped protect her and her baby. Lt. Cmdr. Brown did not feel the need to question Cpt. Mills' reasons for recommending she cease prenatal vitamins because she did not know about folic acid or its implications for the health of her baby and because she had told him that it was Lt. Mukherjee that prescribed them.

Lt. Cmdr. Brown returned for her PAP test and pelvic exam with Cpt. Mills on June 22, 2000. Lt. Cmdr. Brown filled out a medical history form on which she noted she was trying to get pregnant and not taking any medications. The prenatal vitamins were not discussed during this second appointment. Although Lt. Cmdr. Brown told him she had been to the clinic five weeks earlier to update her immunizations, Cpt. Mills recommended she get her typhoid immunization that day. Lt. Cmdr. Brown followed

this direction and received her typhoid immunization immediately after her appointment.

Lt. Cmdr. Brown testified that she followed all her doctors' orders regarding her pregnancy planning. At trial she explained that she did not inform her husband either of her beginning or ceasing to take prenatal vitamins, because "it didn't occur" to her since she "was the one taking the vitamins, not him," and since at that point she thought she was doing the right thing and there was no cause for concern.

After the appointment on June 22, 2007, Lt. Cmdr. Brown had completed all the steps Lt. Mukherjee recommended she take before trying to get pregnant. The next month the Browns received a positive result from a home pregnancy test. To confirm the pregnancy, Lt. Cmdr. Brown returned to the BMC. Lt. Cmdr. Brown scheduled an appointment with Chief Petty Officer ("CPO") Day for August 9, 2000. At that appointment, CPO Day referred Lt. Cmdr. Brown to a civilian obstetrician/gynecologist ("OB/GYN") and recommended prenatal vitamins. When Lt. Cmdr. Brown told CPO Day that Cpt. Mills told her not to take prenatal vitamins, CPO Day said, "well I don't know why he said that, but you need to take them." Lt. Cmdr. Brown filled a new prescription for prenatal vitamins and began taking them that day. Lt. Cmdr. Brown testified that she chose to follow CPO

Dade's recommendation rather than Cpt. Mills' because "he was a specialist, and I was pregnant, and I believed him."

The civilian OB/GYN to which CPO Day referred Lt. Cmdr. Brown referred her in turn to a specialist because of Lt. Cmdr. Brown's age. This second civilian OB/GYN advised Lt. Cmdr. Brown to schedule an amniocentesis. Dr. Phillips performed the amniocentesis and called the Browns a few days later to tell them that the results of the procedure indicated the fetus suffered from spina bifida. Lt. Cmdr. Brown testified that upon hearing this news she and her husband were "horrified," "sad," and "depressed." The Browns performed some cursory research on the internet, which indicated spina bifida could be prevented with folic acid. Lt. Cmdr. Brown testified that this research represented "the first time I had ever heard about folic acid in prenatal vitamins When I went back for the second appointment with Dr. Phillips I told her about Mills' advice, and she said there was no reason for it." On cross-examination, Lt. Cmdr. Brown testified that she was previously aware of prenatal vitamins from pregnancy books she read before seeing Lt. Mukherjee. Lt. Cmdr. Brown testified that her husband, Timothy Brown, called Cpt. Mills during this time but never received a response.

In addition to alerting Cpt. Mills to the news that their fetus suffered from spina bifida, Lt. Cmdr. Brown wrote the Navy

representative at the BMC a letter, detailing the events of the previous months, and filed a formal administrative complaint. Lt. Cmdr. Brown testified that she maintained contact with Navy personnel during her pregnancy and that Patient Representative Pratt told her that when he asked Mills if there were ever a situation when he would recommend a woman not take prenatal vitamins, Mills said, "Yes, in two conditions." At the time of this conversation, Pratt did not remember what those two conditions were, but when he called Mills to clarify, Mills told him the two conditions were hematomacrosis and hemosiderosis.

Lt. Cmdr. Brown testified that Melody Brown was born by Caesarian section. Lt. Cmdr. Brown did not see Melody when she was born because she was immediately transferred to LaBonheur Children's Medical facilities in Memphis, Tennessee. Her first major surgery, to close the open lesion on her back, was performed when Melody was two days old. Lt. Cmdr. Brown saw Melody for the first time after this first surgery. When Melody was five months old she had a second major surgery to insert her ventriculoperitoneal shunt.

Lt. Cmdr. Brown explained that because of her neurogenic bladder, Melody is susceptible to urinary tract infections, which cause a fever. Fever is also a symptom of a shunt malfunction or meningitis, either of which would be extremely serious for Melody. Therefore, Lt. Cmdr. Brown testified,

Melody has been hospitalized multiple times with fevers that were the results of urinary tract infections. Lt. Cmdr. Brown testified that Melody has never shown the dexterity required to manipulate the catheter. Lt. Cmdr. Brown testified that Melody has fine-motor-skills problems and trouble writing. Lt. Cmdr. Brown testified that Melody is aware of and frustrated by her condition. She will go to the bathroom and be unable to urinate and begin crying. Lt. Cmdr. Brown worried that as she gets older this type of frustration will have an increasingly greater impact on Melody. On cross-examination, Lt. Cmdr. Brown testified that she and Timothy have not yet tried to teach Melody to self-catheterize, but that they will introduce the process to her over time.

At trial, Lt. Cmdr. Brown described various family photographs including images of Melody immediately following her first surgery, on vacation, in the hospital with a urinary tract infection, at home doing physical therapy, sitting with her feet on either side of her in a harmful "W" position, learning to walk with a walker and a gait-trainer, walking with crutches, falling on the ground, working with her occupational therapist, performing in her school's holiday show, and swimming with flotation devices. Lt. Cmdr. Brown listed daily tasks related to Melody's condition including catheterization, dressing and undressing, diapering, putting on ankle braces and shoes,

homework, physical therapy, and bathing. Lt. Cmdr. Brown testified to Melody's other conditions, including the difficulty she experiences swallowing water and her diminished sensitivity in her lower extremities.

Lt. Cmdr. Brown explained why she and her husband decided that he would quit his job when Melody was born. Doctors told the Browns that one of the earliest indicators of a ventriculoperitoneal shunt malfunction would be a change in Melody's mood. The Browns realized that a care provider in a day care setting would be much less likely than a parent to recognize such a change in Melody. Therefore, the Browns decided Timothy would be Melody's primary care giver. When Melody was three years old, the Browns enrolled her in a part-time preschool program for children with special needs. Now Melody is enrolled in a non-specialized grade school with a resource assistant and a student helper to aid her in the classroom and when she needs to go to the bathroom. Lt. Cmdr. Brown testified that Melody had told her that other students tease her because she has to wear a diaper and that at recess she just sits and watches the other children jump rope. Even though her mother reminded her that she cannot jump or run, Melody tells her mother she wants to be a cheerleader when she is older.

Lt. Cmdr. Brown testified that she always wanted to have more than one child, that before Melody Brown was born she planned to at least have two children, but that Melody's condition "put a lot of stress" on her and required "more time than a normal child." Lt. Cmdr. Brown testified that after Melody was born "I didn't think I could take the stress or have the time [for another child]. I just couldn't do it."

Timothy Brown

Plaintiff Timothy Brown, Plaintiff Melody Brown's father, testified after his wife. Like Lt. Cmdr. Brown, Timothy also came from a military family and chose to follow their tradition. In 1991, after five years in the Marines, Timothy left the military to work as a civilian computer network technician. He had planned to continue working in this field after Melody was born until he and Lt. Cmdr. Brown learned of Melody's spina bifida.

At trial Timothy remembered when his wife received her amniocentesis. Timothy testified that when Dr. Phillips called with the news that it was a near certainty that the fetus had a neural tube defect, he and his wife did not know what that meant. Neither of the Browns had any family history of neural tube defects. As they learned more about Melody's condition the Browns' plans for Timothy's career began to change. The Browns decided that between the two of them, Timothy should stop

working rather than Lt. Cmdr. Brown, because her benefits would be better for Melody than Timothy's. Timothy testified that he "was reluctant" to stay home with Melody, because he loved his job and wanted to provide for his family.

The Browns' plans for a larger family also changed after Melody's diagnosis. Timothy testified that he and Lt. Cmdr. Brown talked about having multiple children before they were married. Timothy continued to want to have a sibling for Melody after her diagnosis, but because of Lt. Cmdr. Brown's age, Melody's needs, and the strain that her condition put on the Browns' relationship, the Browns never tried for a second pregnancy.

Timothy testified that he knew his wife was seeking pre-conception counseling at the BMC. He knew generally what medications she took, but not how often. He testified that it was not unusual that Lt. Cmdr. Brown did not tell him when she began and stopped taking prenatal vitamins.

During his trial testimony, Timothy provided descriptions of numerous family photographs, including images of Melody's open lesion when she was four hours old, her scar immediately after her first surgery when she was three days old, a hospital stay for a urinary tract infection, physical therapy sessions, walking with a gait-trainer, sitting in the "W" position, wearing orthotic support braces, and listening to speech therapy

tapes. Timothy explained that he is there for "99%" of her appointments and meetings and that he has taken it upon himself to understand the medical and technical details of Melody's condition. Timothy testified that he is motivated to do so in part because he feels that had they known more about prenatal vitamins they could have prevented Melody's spina bifida. Now when the Browns get medical advice they ask questions and inquire about alternative options and sources of information.

At trial Timothy explained that fever and nausea can be indicators of spinal meningitis, shunt malfunction, or hydronephrosis. Every time Melody bumps her head there is a risk that the shunt node behind her ear will have been dislodged. Timothy remembered one particularly scary hospital visit during which a hospital staff member used a "dirty" procedure that resulted in a false positive for spinal meningitis.

Timothy also detailed Melody's various therapeutic exercises, which include exercises to improve Melody's core strength like "curling into an egg," "rolling over," and "kneeling." Timothy also testified that Melody uses an electro-muscular stimulator to activate and strengthen her core muscles. Timothy built a stability bar along a hallway in the Browns' home to help Melody learn to walk. A continuing project is to discourage Melody from sitting in the "W" position. Melody

likes to sit with her knees bent and her feet on either side of her because it gives her a wide base of support. Melody's core muscles in her abdomen and back are too weak to hold her upright sitting normally, so the "W" position is more comfortable for her. Timothy explained that the "W" position stretches the ligaments and tendons in her knees, further weakening and deforming them and making it increasingly difficult for her to walk. Melody does not feel the damage she inflicts on her knee joints because she suffers from diminished sensitivity in her lower extremities. Crawling on concrete pavement, Melody would cut and scrape her feet and legs without noticing because of this decreased sensitivity; now, Melody always wears protective shoes and clothes. Timothy also testified about his and Melody's occupational therapy work, which involves detailed movement like feeding and dressing, and their speech therapy exercises.

At trial Timothy narrated a "day in the life" video of Melody. First Timothy explained how he helps Melody get ready for school in the morning. Melody can get out of bed, but only by rolling to the side; she lacks the strength to sit up on her own. When she walks without braces or orthotic support her feet roll inward and she walks on the inner soles of her feet. Melody can only walk a few steps like this before losing her balance, so she leans on walls and countertops to reach the

bathroom. Melody wears a diaper at night, and Timothy catheterizes her each morning. Timothy explained how he sterilizes his hands and the catheter to protect Melody from urinary tract infections. Timothy testified that Melody "can't sit herself up to open her legs to [catheterize herself]. She doesn't have those core muscle groups. We tried recently. She's just not there. . . . Melody doesn't have upper body strength or dexterity. She doesn't have single digit distinction. She can't hold a pencil effectively. Even if she could do the core, which she can't, she can't do the intricacy."

Other morning routines Timothy described include fitting her ankle-foot orthotics. This involves threading a Velcro strap through a small slot to secure her ankles and then slipping her shoes on over the braces. Melody has the ability to pull the Velcro, but she gets frustrated and cannot thread the Velcro or get her shoes on over the braces. Melody has learned to remove the orthotics. Melody also cannot brush her hair because she lacks the strength to hold her arms behind her head. Melody also lacks the strength to hold herself upright at the breakfast table; she uses a booster seat and the table to keep herself stable. Brushing her teeth is also a risky task for Melody because she falls so often.

Timothy also testified about Melody's interactions with other children on the playground. Melody loves people and talks

to strangers easily, but she is slow on the jungle gym and playground equipment and is quickly left behind by playmates. One of her fellow kindergarteners calls her "the one with the broken legs." Timothy testified that comments like these frustrate Melody. Melody's school has determined that Melody needs a full time aid in class; otherwise, Timothy testified, the teacher would be overburdened.

Explaining Melody's cognitive limitations, Timothy testified that every day Melody says she did the same thing at school. She does not learn people's names, so the Browns take pictures of Melody's classmates to review with her each night. This repetitive action helps her. Demonstrating another cognitive abnormality, Timothy testified that Melody has no problem talking, hugging, or kissing strangers. She does not see danger. The Browns worry that a stranger will pick her up from school or hurt her because "anyone that wants to talk to her can be her best friend. She's naïve and young, we're hoping she'll grow out of it, but most kids already know these things."

Dr. Joseph Bruner

Dr. Joseph Bruner, an expert medical witness for the defense, testified as to the relevant standard of care in Memphis, Tennessee, in 2000 and as to the probability that Cpt. Mills' treatment caused Melody Brown's spina bifida. Dr. Bruner graduated from the University of Nebraska Medical Center's

College of Medicine in Omaha, Nebraska, in 1979 and completed his internship and residency in obstetrics and gynecology at Letterman Army Medical Center at the Presidio in San Francisco, California, from 1979 to 1983. Dr. Bruner later completed a fellowship in maternal-fetal medicine at the Hospital of the University of Pennsylvania in Philadelphia, Pennsylvania from 1988 to 1990. Dr. Bruner served as an Associate Professor in Obstetrics, Gynecology, and Radiology at Vanderbilt University Medical Center in Nashville, Tennessee, from 1990 to 2005. Dr. Bruner now serves as a perinatologist at The Perinatal Center at Fort Sanders Regional Medical Center in Knoxville, Tennessee.

Dr. Bruner, in his expert report (Trial Ex. 29), reported that folic acid is a type of B vitamin, critical for cell division due to its essential role in the synthesis of nucleic and amino acids. Dr. Bruner cited several lines of scientific evidence that support the hypothesis that folate deficiency is implicated in the development of neural tube defects, including myelomeningocele like Melody Brown's. Dr. Bruner's report supports the hypothesis that folic acid facilitates rapid cell turnover at a critical point in the closure of the neural tube. Dr. Bruner cites studies finding varying degrees of neural tube risk reduction in correlation to folic acid supplementation ranging from 75% at four milligrams per day to 57% at one milligram per day. Dr. Bruner's report also detailed the

decision in 1998 by the United States Food and Drug Administration to require folic acid fortification of the food supply. According to Dr. Bruner's report, this fortification was designed to reduce the incidence of neural tube defects by 20%. In his expert report Dr. Bruner opined that if Lt. Cmdr. Brown "had taken folic acid supplements of 0.4 to 0.8 mg of folic acid daily, beginning one month prior to conception and continuing through the first trimester of her pregnancy, the risk of Melody Brown developing spina bifida would have been reduced at least 36%, and potentially up to 50%." Dr. Bruner stated that any more supplementation than that would have placed Lt. Cmdr. Brown at risk of developing vitamin B12 deficiency. Dr. Bruner concluded that, "within a reasonable degree of medical certainty, recommended levels of folic acid supplementation would not have prevented the development of spina bifida in Melody Brown."

At trial Dr. Bruner testified that, based on new data from the Center for Disease Control, it was his opinion that Lt. Cmdr. Brown's background serum folate level was more than ten nanograms per milliliter, more than double the level he previously used in applying the Wald model in his expert report. Dr. Bruner testified that this increase in serum folate concentration would decrease the effectiveness of daily folic acid supplements - reducing the risk of neural tube defects from

57% as originally calculated to between 35% and 41%. On cross examination, Dr. Bruner explained that the Wald model was based on a study of Canadian women. Dr. Bruner conceded that Wald and his co-authors suggested that, because they receive greater food fortification, American women experience higher risk reduction rates than reported in the study. Finally, Dr. Bruner explained that the Wald model assumed that five nanograms per milliliter was the average serum folate level. The model's risk reduction statistics for other background folate levels were mathematical extrapolations from those base numbers rather than the result of population data.

At trial, Dr. Bruner also testified that the window during which a neural tube defect occurs could be as much as the first thirty days of gestation. On cross-examination, Dr. Bruner conceded that the same literature which suggests the window of neural tube defect formation may extend into the thirtieth day of gestation also notes that for folic acid supplements to effectively prevent such defects they must be taken before conception and through the first four weeks of pregnancy.

On cross-examination, Dr. Bruner agreed with Plaintiffs' experts that the relevant standard of care in Memphis, Tennessee, in 2000 was to recommend folic acid supplements before and after conception to any woman trying to get pregnant. Dr. Bruner also agreed on cross-examination that Lt. Cmdr. Brown

did not present any of the other risk factors for neural tube defects besides inadequate folic acid. In his redirected testimony, Dr. Bruner clarified that some risk factors render patients more responsive to folic acid supplementation, and so this circumstance does not necessarily indicate lack of folic acid as the cause of Melody Brown's spina bifida.

Dr. Frank Ling

Dr. Frank Ling, the final medical expert for the defense, is a licensed OB/GYN in Tennessee and Arkansas. He currently holds academic appointments at the University of Tennessee and Vanderbilt University and maintains a clinical practice. Dr. Ling testified as to the relevant standard of care in the Memphis, Tennessee, area in 2000 and as to the probability that Cpt. Mills' treatment caused Melody Brown's spina bifida.

Dr. Ling testified that Cpt. Mills did not violate the standard of care. Dr. Ling testified that a doctor serving in a pre-conception capacity was obligated by the standard of care in the Memphis community to recommend folic acid supplements. However, Dr. Ling qualified this opinion by distinguishing the circumstances of Lt. Cmdr. Brown's appointments with Cpt. Mills from a pre-conception appointment. In Dr. Ling's expert opinion, the scope of the appointments in question did not include pre-conception concerns. Therefore, according to Dr. Ling, the standard of care for a pre-conception appointment was

not the relevant standard of care in this case. Rather, Dr. Ling testified, this appointment was a routine pelvic exam and PAP test, which should not include pre-conception counseling or a recommendation for folic acid supplements. On cross-examination Dr. Ling did not recall that the reason Lt. Cmdr. Brown set her appointments with Cpt. Mills was because Lt. Mukherjee recommended she do so in preparation for her first pregnancy. On cross-examination, when asked what expectations he would have for himself if he saw a woman whom he knew was trying to get pregnant, Dr. Ling testified that he would expect himself to counsel that patient to take prenatal folic acid supplements.

Dr. Ling did not rely on population studies in presenting his opinion as to the likelihood that Melody Brown's spina bifida was proximately caused by a lack of folic acid supplementation. Dr. Ling testified that a population study on neural tube defect risk reduction could not accurately identify the cause of a particular patient's condition. On cross-examination Dr. Ling testified that although he tells his own patients that folic acid supplementation reduces their risk of having a child with a neural tube defect by 50-70%, this statistic and others like it based on populations studies are not a predictive measure for any individual.

II. Findings of Fact

Based on the testimony and entire record in this case, the Court makes the following findings of fact:

In anticipation of becoming pregnant, Lt. Cmdr. Brown sought pre-conception counseling on April 17, 2000, at the BMC. On that date, Lieutenant Sanjoydeb Mukherjee prescribed an 800 microgram daily dose of prenatal vitamins, which Deborah began taking.

Prenatal vitamins are prescribed, in part, to provide folic acid, which reduces the risk of neural tube defects (i.e. malformations of the spinal cord and brain), including spina bifida - the most common form of neural tube defect. Neural tube defects occur in the first four weeks of gestation.

In addition to the prenatal vitamins, Lt. Mukherjee recommended that Lt. Cmdr. Brown wean herself from her migraine medication and schedule a pelvic exam, pelvic ultrasound, and PAP test before she conceived. Lt. Mukherjee met with Lt. Cmdr. Brown for a follow-up visit to administer the pelvic ultrasound, which did not reveal any abnormalities, on May 8, 2000.

Lt. Cmdr. Brown returned to the BMC on June 16, 2000, for a five-year physical exam and to receive a pelvic exam and PAP test as Lt. Mukharjee had recommended. That day, on her Physical Examination Questionnaire, Lt. Cmdr. Brown stated that she was "trying to get pregnant," and taking prenatal vitamins.

During the appointment Cpt. Mills, the Senior Medical Officer at the BMC, spoke to Lt. Cmdr. Brown about certain health risks associated with iron supplements in prenatal vitamins. Lt. Cmdr. Brown stopped taking prenatal vitamins that day. Cpt. Mills also referred Lt. Cmdr. Brown to another section of the BMC for a recommended typhoid immunization. Captain Leland Mills scheduled a follow-up appointment for the pelvic exam and PAP smear.

Lt. Cmdr. Brown returned to the BMC on June 22, 2000, for her follow-up pelvic exam and PAP test with Cpt. Mills. On that day, Lt. Cmdr. Brown filled out a Chronological Record of Medical Care Standard Form on which she indicated that she was no longer taking prenatal vitamins and still trying to get pregnant. During the appointment Lt. Cmdr. Brown again told Cpt. Mills of her desire to become pregnant, a fact which Cpt. Mills noted in his records. Cpt. Mills did not discuss prenatal vitamins with Lt. Cmdr. Brown on June 22, 2000. Lt. Cmdr. Brown remained off her prenatal vitamin prescription.

Lt. Cmdr. Brown conceived a child approximately four weeks later, between July 13 and 15, 2000. On August 9, 2000, Lt. Cmdr. Brown saw CPO Anthony Day at the BMC. CPO Day confirmed Lt. Cmdr. Brown's pregnancy and gave her a new prescription for prenatal vitamins and referrals to a civilian obstetrician and to Lieutenant Elter in the BMC's prenatal clinic. Lt. Cmdr.

Brown filled and began taking the new prescription for prenatal vitamins on August 9, 2000, immediately following her appointment with CPO Day.

In October of 2000, Lt. Cmdr. Brown decided to undergo an amniocentesis, the results of which indicated that her fetus had a leaking fetal lesion of neuronal origin. Ultrasound analysis confirmed that the fetus suffered from spina bifida with a Type II Chiari malformation and L-4 and L-5 spinal defects. Melody Brown was born on March 28, 2001, with myelomeningocele, the most serious form of spina bifida.

III. Conclusions of Law

Section 29-26-115 of the Tennessee Code² sets forth a plaintiff's burden of proof in a medical malpractice case and provides as follows:

(a) In a malpractice action, the claimant shall have the burden of proving by evidence as provided by subsection (b):

- (1) The recognized standard of acceptable professional practice in the profession and the specialty thereof, if any, that the defendant practices in the community in which the defendant practices or in a similar community at the time the alleged injury or wrongful action occurred;
- (2) That the defendant acted with less than or failed to act with ordinary and reasonable care in accordance with such standard; and
- (3) As a proximate result of the defendant's negligent act or omission, the plaintiff suffered injuries which would not otherwise have occurred.

² The liability of the United States under the FTCA is determined "in accordance with the law of the place where the act or omission occurred." 28 U.S.C. § 1346(b).

(b) No person in a health care profession requiring licensure under the laws of this state shall be competent to testify in any court of law to establish the facts required to be established by subsection (a), unless the person was licensed to practice in the state or a contiguous bordering state a profession or specialty which would make the person's expert testimony relevant to the issues in the case and had practiced this profession or specialty in one (1) of these states during the year preceding the date that the alleged injury or wrongful act occurred. This rule shall apply to expert witnesses testifying for the defendant as rebuttal witnesses. The court may waive this subsection (b) when it determines that the appropriate witnesses otherwise would not be available. . . .

(d) In a malpractice action as described in subsection (a) . . . the claimant has the burden of proving, by a preponderance of the evidence, the negligence of the defendant.

Tenn. Code. Ann. § 29-26-115 (2005).

The issues before the Court are as follows: (A) what the recognized standard of care in the Memphis, Tennessee, area was in 2000, governing the prescription of prenatal vitamins with folic acid supplements to a woman who is planning on becoming pregnant; (B) whether Capt. Mills' treatment of Lt. Cmdr. Brown fell below that standard; (C) whether Capt. Mills' treatment was the proximate cause of Melody and Timothy Brown's injuries, which would otherwise not have occurred; and (D) what damages, if any, resulted from those injuries.

A. Standard of Care

Under Tennessee Code Annotated § 29-26-115(1)(a), known as the "locality rule," a party proffering expert testimony regarding the applicable standard of care must demonstrate that the expert has knowledge of the standard of care applicable in the defendant's community. See Robinson v. LeCorps, 83 S.W.3d 718, 724 (Tenn. 2002). In this case, the parties agreed this burden was met as to Dr. Martin, Dr. Bruner, and Dr. Ling.

All three trial experts agreed in their testimony that a doctor practicing in Memphis, Tennessee, in 2000, who is aware that his patient is planning to become pregnant would reasonably be expected to have recommended folic acid supplements. Dr. Martin testified that since 1992, the standard of care in the community has been to prescribe prenatal vitamins including folic acid to a woman who plans to become pregnant. When asked if he agreed with Dr. Martin's assessment, Dr. Bruner testified that the standard of care in Memphis in 2000 was to recommend a folic acid supplement before and after conception. Dr. Ling also testified that a doctor providing pre-conception services was obligated by the standard of care in the Memphis community to recommend folic acid supplements. On cross-examination, when asked what expectations he would have for himself if he saw a woman who he knew was trying to get pregnant, Dr. Ling testified that he would counsel that patient to take prenatal folic acid supplements. Dr. Ling's testimony that recommending prenatal

vitamins is inapplicable in this case because the appointments with Cpt. Mills were not in a pre-conception context is unpersuasive because Dr. Ling did not recall that the appointments were scheduled as part of Lt. Cmdr. Brown's pre-pregnancy planning.

Lt. Cmdr. Brown scheduled her pelvic exam and PAP smear because Lt. Mukherjee recommended she do so in anticipation of becoming pregnant. During both of the appointments with Cpt. Mills, the purpose of her visit, specifically her desire to become pregnant in the coming months, was a topic of discussion that Cpt. Mills noted in his records. The Court finds that both appointments with Cpt. Mills were in a pre-conception context. Accordingly the Court finds that the weight of the evidence supports the conclusion that the recognized standard of care applicable to both of Lt. Cmdr. Brown's appointments with Cpt. Mills required him to recommend prenatal vitamins to her.

B. Violation

Under Tennessee law, proof regarding the "failure of a physician to adhere to an acceptable standard of care in treating a patient must be by expert medical testimony." Williams v. Baptist Mem'l Hosp., 193 S.W.3d 545, 553 (Tenn. 2006). In this case, the parties agreed that Dr. Martin, Dr. Bruner, and Dr. Ling satisfied the locality rule requirements to testify as to whether or not Cpt. Mills' treatment of Lt. Cmdr.

Brown fell below the standard of care. As discussed above, all three experts agreed that in a pre-conception context a doctor would have been expected under the standard of care in Memphis, Tennessee, in 2000, to recommend prenatal vitamins to a patient who was known or reasonably believed to be planning a pregnancy.

Testimony at trial produced conflicting evidence as to the content of the discussion Cpt. Mills had with Lt. Cmdr. Brown during her June 16, 2000, appointment. Lt. Cmdr. Brown testified that Cpt. Mills strongly recommended she cease her daily dosage of prenatal vitamins. Cpt. Mills testified that he discussed the possible risk to some women that iron supplements may pose but did not recommend that Lt. Cmdr. Brown stop taking prenatal vitamins. The medical records lack any reference to this conversation.

Testimony concerning the June 22, 2000, appointment was less contested. Cpt. Mills had no recollection of that day. Lt. Cmdr. Brown testified that on June 22, she again informed Cpt. Mills of her intent to become pregnant and indicated in her clinic paperwork that she was no longer taking prenatal vitamins. Though Capt. Mills did not remember his meeting with Lt. Cmdr. Brown on the 22nd, he could confirm her testimony because his notes from that day also indicated that Lt. Cmdr. Brown would soon be trying for a pregnancy. Cpt. Mills testified that he did not notice that Lt. Cmdr. Brown had

stopped taking prenatal vitamins. Moreover, he testified that his failure to read this section of her paperwork was an "unfortunate oversight."

The Court need not resolve the factual dispute regarding the June 16, 2000, appointment because the events of the 22nd of June are sufficient to establish a violation of the standard of care in this case. On the 22nd, Mills knew or should have known both that Lt. Cmdr. Brown was trying to get pregnant and that she was not taking prenatal vitamins. Regardless of whether or not Lt. Cmdr. Brown stopped taking prenatal vitamins at Cpt. Mills' direction, all the expert testimony supports the conclusion that by failing to discuss and recommend prenatal vitamins with a patient in Lt. Cmdr. Brown's circumstances, Cpt. Mills violated the standard of care on June 22, 2000.

C. Causation

Tennessee law requires that proof of proximate causation in medical malpractice actions be established by expert testimony. See Phelps v. Vanderbilt Univ., 520 S.W.2d 353, 357 (Tenn. Ct. App. 1974). A plaintiff must introduce evidence that affords a reasonable basis for the conclusion that it is more likely than not that the conduct of the defendant was a cause in fact of the result. See Taylor v. Jackson-Madison County Gen. Hosp. Dist., 231 S.W.3d 361, 366 (Tenn. Ct. App. 2006). A mere possibility of such causation is not enough. See Kilpatrick v. Bryant, 868

S.W.2d 594, 602 (Tenn. 1993). Proof of causation equating to a "possibility," a "might have," or "could have" is not sufficient, as a matter of law, to establish the required nexus between the plaintiff's injury and the defendant's tortuous conduct by a preponderance of the evidence in a medical malpractice case. Id. Causation in fact is a matter of probability, not possibility, and in a medical malpractice case, such must be shown to a reasonable degree of medical certainty. Id.

In this case, Dr. Martin, Dr. Leichtman, Dr. Bruner, and Dr. Ling all provided expert testimony as to the causal link between the failure to take prenatal folic acid supplements during the first twenty-six to twenty-eight days of fetal gestation and the occurrence of spinal bifida. All four experts agreed that the primary purpose of folic acid supplementation is to prevent neural tube defects. All four experts also agreed that Lt. Cmdr. Brown did not present any of the known risk factors for spina bifida; specifically, there was no evidence that Lt. Cmdr. Brown suffered from diabetes or high core temperatures during her pregnancy, had a genetic predisposition for neural tube defects, or took anti-convulsant medications while she was carrying Melody.

Though the Court agrees with Dr. Ling that a general study cannot perfectly predict the outcome in any individual set of

circumstances, Tennessee courts recognize and accept population studies as a basis for expert testimony on causation in medical malpractice cases. See, e.g., Harris v. Baptist Mem. Health Care Corp., 2005 WL 123455 (Tenn. Ct. App. Jan. 21, 2005)(affirming a grant of summary judgment for the defendant in a wrongful death action because the plaintiff's expert witness on causation could not produce any population study showing that the deceased had a greater than 50% chance of survival, i.e. that but for the alleged negligence, she would have been more likely than not to survive); Dubois v. Haykal, et al., 165 S.W.3d 634 (Tenn. Ct. App. 2004)(reversing the trial court's grant of summary judgment based on failure to establish causation in a medical malpractice suit by a woman who conceived while taking oral contraceptives and who claimed that her pregnancy was caused by the negligent prescription of Tegretol, a drug that population studies had shown impacted the effectiveness of oral contraceptives); Richardson v. Miller, 44 S.W.3d 1 (Tenn. Ct. App. 2000) (upholding the trial court's refusal to direct the verdict for the defendant where expert testimony on the increased risk of heart attack due to the administration of terbutaline created "a jury question on causation" because "[w]eighing the evidence is the jury's task"). Accordingly, the Court will include the experts' statistical data in its evaluation of the evidence presented at trial.

Dr. Martin, Dr. Leichtman, and Dr. Bruner all relied primarily on the neural tube defect risk reduction model promulgated by N.J. Wald, et al., in "Quantifying the effect of folic acid," 358 LANCET 2069 (2001). At trial it was Dr. Leichtman's expert opinion that the lack of folic acid supplementation during Lt. Cmdr. Brown's first twenty-six to twenty-eight days of pregnancy was more likely than not the cause of Melody's spina bifida within a reasonable degree of medical certainty. Dr. Martin testified that a meta-analysis of folic acid supplementation studies concluded that food fortification alone is insufficient to prevent the majority of neural tube defects, but that a supplement in the amount prescribed to Lt. Cmdr. Brown could prevent 60% to 70% of neural tube defects within a reasonable degree of medical certainty.

Though he too relied primarily on the Wald model in reaching his expert opinion, Dr. Bruner testified that the lack of folic acid supplementation was not the more likely cause of Melody's spina bifida. In his expert report, Dr. Bruner cited the same 57% risk reduction rate relied upon by Dr. Martin and Dr. Leichtman. At trial Dr. Bruner testified that based on new data from the Center for Disease Control, it was his opinion that daily folic acid supplements reduced Lt. Cmdr. Brown's risk of neural tube defects by between 35% and 41%.

Viewing all the evidence in the record, the Court finds that Plaintiffs have proven by a preponderance of the evidence that Cpt. Mills' failure to prescribe prenatal vitamins to Lt. Cmdr. Brown was the proximate cause of Melody Brown's spina bifida. All the experts agreed that Lt. Cmdr. Brown's only risk factor was a lack of folic acid supplementation. All the experts agreed that the consensus in the scientific community is that daily folic acid supplementation significantly reduces the risk of neural tube defects. The experts testified that most studies report risk reduction rates between 50% and 92%. Dr. Ling, who testified that the lack of folic acid supplementation was not the proximate cause, cites a 50%-70% risk reduction in his practice. Dr. Bruner's trial testimony discredits his original report, in which he opined that a lower supplementation level was applicable, and is of limited weight because the new Center for Disease Control data on which he relies was not known when the Wald extrapolations were designed. Accordingly, the Court finds that the preponderance of the evidence in this case supports the conclusion that Dr. Mills' violation of the standard of care was the proximate cause of Melody Brown's spina bifida.

IV. Damages

When proving damages, the evidence should "lay a foundation enabling the triers of the facts to make a fair and reasonable

assessment of damages." Wilson v. Farmers Chem. Ass'n, 444 S.W.2d 185, 189 (Tenn. Ct. App. 1969); see also Pinson & Assoc. Ins. Agency, Inc. v. Kreal, 800 S.W.2d 486 (Tenn. Ct. App. 1990). Tennessee law does not require that a plaintiff prove the amount of damages with mathematical certainty where there is substantial evidence from which reasonable inferences may be drawn. Cummins v. Brodie, 667 S.W.2d 759, 765 (Tenn. Ct. App. 1983); see also Potts v. Celotex Corp., 796 S.W.2d 678, 681 (Tenn. 1990)(quoting Md. Cas. Co. v. Young, 362 S.W.2d 241, 243 (Tenn. 1962); Williams v. Daniels, 344 S.W.2d 555, 559 (Tenn. Ct. App. 1960)). All that an award for damages requires is proof of damages within a reasonable degree of certainty. BancorpSouth Bank, Inc. v. Hatchel, 223 S.W.3d 223, 230 (Tenn. Ct. App. 2006).

Pain and suffering, permanent injury, and loss of enjoyment of life each represent separate losses for which a plaintiff may recover. Thompson v. Nat'l R.R. Passenger Corp., 621 F.2d 814, 824 (6th Cir. 1980). Permanent injury compensates the victim for the fact of being permanently impaired whether or not it causes any pain or inconvenience; pain and suffering compensates the victim for the physical and mental discomfort caused by the injury; and loss of enjoyment of life compensates the victim for the limitations on the person's life created by the injury. Id.; see also Lang v. Nissan N. Am., Inc., 170 S.W.3d 564, 571

(Tenn. 2005); Martin v. S. Ry. Co., 463 S.W.2d 690, 691 (Tenn. 1970); Dixie Feed & Seed Co. v. Byrd, 376 S.W.2d 745, 753 (Tenn. Ct. App. 1963)(finding that intangible elements of damages include "pain and suffering, inconvenience and the deprivation of the enjoyment of the normal activities of life"). Other considerations for determination of damages include the nature and extent of the injury, expenses, loss of earning capacity, percentage of permanent disability, inflation, and the amount awarded in similar cases. See Tullos v. Corley, 337 F.2d 884, 887 (6th Cir. 1964); Yellow Cab Co. of Nashville, Inc. v. Pewitt, 316 S.W.2d 17 (Tenn. Ct. App. 1958); France v. Newman, 248 S.W.2d 392 (Tenn. Ct. App. 1951).

Plaintiffs and Defendant retained experts for the calculation of Melody's future medical costs. Plaintiffs' expert, Dr. Robert D. Voogt, prepared a life care plan (Trial Ex. 16) estimating Melody Brown's future medical and rehabilitative needs and testified at trial. Robert H. Jackson prepared a similar expert report (Trial Ex. 28) for the Government and also testified at trial. The Government also sought Dr. David C. Sharp's expert opinion of Melody's lost earning capacity and the present value of her future medical costs. (Trial Ex. 34.) Before trial, the parties stipulated (1) that Melody's lost earning capacity was \$1,115,685.00, (2) that Timothy Brown's expenses for Melody's past medical care

were \$6,211.00, (3) that the present value of Mr. Jackson's life care plan was \$3,758,263.00, (4) that the present value of Dr. Voogt's life care plan was \$14,890,880.00, (5) that any award of future medical costs should be reduced by 7.06% to reflect the present value of Melody's TRICare benefits, and (6) that if the Court determined that Defendant was entitled to an offset under the Individuals with Disabilities Education Act, 20 U.S.C. § 1401 et seq., then that offset would be \$117,053.00.

Plaintiffs also seek compensation for Timothy Brown's past and future care for Melody (\$2,833,441.29). Finally, Plaintiffs seek awards of two million dollars for Melody's physical pain and suffering, one million dollars for Melody's mental pain and suffering, two million dollars for Melody's physical impairment, two millions dollars for Melody's mental impairment, two million dollars for Melody's disfigurement, and two million dollars for Melody's lost capacity for enjoyment of life.

A. Trial Testimony of Dr. Voogt

Dr. Voogt earned his Bachelor of Arts degree from Calvin College in 1972 and his Master of Arts and doctorate degrees in Rehabilitation Counseling from the University of Michigan in 1974 and 1978, respectively. Over the last three decades Dr. Voogt has worked as a Rehabilitation Specialist in various academic and private sector institutions. For the past three years, Dr. Voogt has served as CEO and Program Manager for

Neurological Rehabilitation Living Centers in Virginia and Louisiana. Before issuing his expert report and trial testimony, Dr. Voogt examined Melody and met with the Browns.

In Dr. Voogt's expert opinion, Melody's physical and mental impairments will require lifelong supportive services and medical care. Among other symptoms, Dr. Voogt observed that Melody has no aversion to strangers, moves constantly, and suffers from gross and fine motor impairment.

At trial, Dr. Voogt presented his life care plan. It provides for regular medical care from physiatrists, family practitioners, neurologists, neurosurgeons, orthopedic surgeons, ophthalmologists, and urologists. Dr. Voogt's life care plan also allocates funds for physical, occupational, and emotional therapy, as well as for professional case management to coordinate these services. Finally, Dr. Voogt's life care plan recommends that a licensed practical nurse provide Melody with attendant care throughout her life. Dr. Voogt recommended a licensed nurse as opposed to a lower-cost care provider because he believes that Melody will not learn to self-catheterize and will, therefore, require specialized assistance throughout her life. Dr. Voogt recommended Melody receive these supportive services for eight hours a day until she turns eighteen, when she would no longer be with her parents and require supportive services twenty four hours per day. Finally, Dr. Voogt

recommended that Melody receive her supportive services through an agency as opposed to finding aides on her own.

Dr. Voogt made the following cost predictions for Melody's care based on services currently available in the Memphis, Tennessee, area: (1) non-annual costs for medical evaluations (\$1,531.00), counseling (\$22,854.00), and equipment (\$11,785.00); (2) annual costs while Melody is a minor receiving care from her parents for medical treatment (\$1,581.00), rehabilitation therapies (\$66,467.00), case management (\$6,480.00), support care for eight hours per day from a licensed nurse (\$48,400.00), and equipment (\$8,383); and (3) annual costs once Melody reaches majority for medical and therapeutic evaluations (\$1,695.00); case management (\$6,480.00), support care for twenty-four hours per day from a licensed nurse (\$175,200.00), residential maintenance (\$7,015.00), and equipment (\$4,783.00). Assuming Melody would reach majority and that government assistance would not cover these costs, the parties agreed that that the present value of Dr. Voogt's life care plan is \$14,890,880.00.

B. Trial Testimony of Mr. Jackson

Mr. Jackson earned his Bachelor of Arts in rehabilitation case management from DePaul University in 1992. Mr. Jackson attended continuing education courses in rehabilitation management and life care planning at Northwestern University

Medical School and the University of Florida in Gainesville, Florida. Since 1987, Mr. Jackson has served as the President and General Manager of Robert H. Jackson & Associates, Inc., a catastrophic injury consulting and management firm.

Mr. Jackson's recommendations for Melody's annual medical, therapeutic, equipment, case management, and residential needs were substantially similar to those of Dr. Voogt. In addition to the provisions in Dr. Voogt's report, Mr. Jackson also allocated funds for medications, shunt replacements, summer camp, and driver education.

The most significant difference between Mr. Jackson's and Dr. Voogt's recommendations concerned Melody's support care. Unlike Dr. Voogt, Mr. Jackson assumed that Melody would learn to self-catheterize by age twelve. Mr. Jackson's research suggested that children with spina bifida generally begin learning to self-catheterize when they are five or six years old and master the technique in approximately six years. Accordingly, Mr. Jackson recommended that a licensed nurse assist Melody until she learns to self-catheterize and that thereafter, Melody receive assistive services from an unlicensed aide. While Dr. Voogt recommended that a licensed nurse assist Melody at all times once she reached the age of majority, Mr. Jackson suggested that once Melody learned to self-catheterize, she would need professional care only six hours per day.

Finally, Mr. Jackson advised that Melody and the Browns seek privately-hired as opposed to agency-provided support care.

These recommendations resulted in the following cost predictions for Melody's care: (1) non-annual costs for medical evaluations and care (\$214,896.00), counseling (\$22,603.00), residential modifications (\$48,456.00), and educational evaluations (\$3,740.00); and (2) average annual costs for medical treatment (\$1,993.00), rehabilitation therapies (\$5,397.00), case management (\$10,934.00), support care (\$35,245.00), residential maintenance (\$3,360.00), and equipment (\$10,372.00). Assuming Melody would reach majority, the parties agreed that the present value of Mr. Jackson's life care plan is \$3,758,263.00.

C. Analysis

First, the Court AWARDS the following stipulated sums: \$1,115,685.000 to Melody Brown for her lost earning capacity and \$6,211.00 to Timothy Brown for his past expenses incurred in caring for Melody.

Second, the Court AWARDS Melody Brown \$2,450,000.00 in compensation for her physical impairments, disfigurement, and physical pain and suffering. There was extensive trial testimony regarding Melody's physical condition. Both Plaintiffs' and Defendant's experts agreed that Melody is severely impaired as a result of her spina bifida, that she will

lose the ability to walk and, therefore, will use a wheelchair for most of her life, that she will never attain full fine or general motor function, that she will always suffer from bladder and bowel dysfunction, and that she will continue to experience decreased sensitivity in her lower body. Accordingly, the preponderance of the evidence fairly and reasonably supports the assessment of \$2,450,000.00 in compensation for Melody's physical injuries.

Third, the Court AWARDS Melody Brown \$3,650,000.00 in compensation for her mental impairment, lost capacity for enjoyment of life, and mental pain and suffering. All four trial witnesses with personal knowledge of Melody's emotional condition and behavior - Lt. Cmdr. Brown, Timothy Brown, Dr. Leichtman, and Dr. Voogt - commented that Melody is easily frustrated, that Melody has no fear of strangers or dangerous conditions, and that Melody has significant cognitive impairment. In addition, Melody's physical conditions, particularly her difficulty walking and her bowel and bladder dysfunction, will continue to be a source of emotional and mental stress. Accordingly, the preponderance of the evidence fairly and reasonably supports the assessment of \$3,650,000.00 in compensation for Melody's mental and emotional injuries.

Fourth, the Court AWARDS Melody Brown \$6,468,752.17 in compensation for her future medical, health, and attendant care

costs. Plaintiffs' and Defendant's damages experts reached significant agreement with respect to Melody's annual medical costs: Dr. Voogt recommended allocating \$1,581.00 per year but did not include the \$1,192.00 Mr. Jackson predicted would be incurred annually for a podiatrist, a neurologist, diagnostic testing, and medications. Dr. Voogt's estimates used current prices from Memphis, Tennessee, health providers, while Mr. Jackson relied on national rates discounted to reflect local pricing. Accordingly, the preponderance of the evidence fairly and reasonably supports the assessment of \$2,595.00 per year in compensation for Melody's annual medical costs.

Plaintiffs' and Defendant's damages experts also presented substantially similar estimates for Melody's annual rehabilitation and case management costs: Dr. Voogt estimated \$71,820.00 until Melody turned eighteen and \$7,425.00 thereafter, while Mr. Jackson suggested an average annual expenditure of \$16,331.00. Again, Dr. Voogt's rehabilitation estimates used current prices from Memphis, Tennessee, health providers, and Mr. Jackson's did not. Accordingly, the preponderance of the evidence fairly and reasonably supports the assessment of \$70,000.00 per year while Melody is a minor and \$7,425.00 once Melody reaches the age of majority in compensation for Melody's annual rehabilitative and case management costs.

Plaintiffs' and Defendant's damages experts also presented relatively equivalent estimates for Melody's annual equipment and residential maintenance costs. Accordingly, the preponderance of the evidence fairly and reasonably supports the assessment of \$11,150.00 per year for equipment until Melody is eighteen and \$14,580.00 annually for equipment and residential maintenance once Melody is an adult.

Plaintiffs' and Defendant's damages experts also reached substantially similar estimates for Melody's mental health services: Dr. Voogt allocated \$26,000.00, while Mr. Jackson estimated \$22,602.52. Again, Dr. Voogt's rehabilitation estimates used current prices from Memphis, Tennessee health providers, and Mr. Jackson's did not. Accordingly, the preponderance of the evidence fairly and reasonably supports the assessment of \$26,000.00 in compensation for Melody's one-time mental health services.

Although the parties did not agree on the type, duration, or level of expertise of Melody's attendant care, the Court finds that the preponderance of the evidence fairly and reasonably supports provision for an agency-acquired, licensed nurse eight hours per day while Melody is a minor and sixteen hours per day once Melody is an adult. Accordingly, the Court allocates \$52,200.00 per year until Melody is eighteen and \$105,120.00 thereafter for attendant services.

The parties also did not agree on the value of Melody's one-time medical and educational costs: Mr. Jackson's estimate included funds for shunt revisions, while Dr. Voogt's included educational evaluations throughout Melody's development. At trial, Dr. Martin and Dr. Leichtman both confirmed Mr. Jackson's assumption that as Melody grows she will require multiple shunt revisions. Accordingly, the preponderance of the evidence fairly and reasonably supports the assessment of \$215,000.00 in compensation for Melody's one-time medical costs and an additional \$20,000.00 for Melody's educational evaluations.

Fifth and finally, the Court declines to award Timothy Brown compensatory damages for past and future care of his daughter. Plaintiffs failed to present evidence that Timothy Brown should be compensated as a licensed nurse working eight hours every day would be compensated. Moreover, Plaintiffs failed to provide any legal precedent that a parent may recover compensatory damages for the care of an injured child. Accordingly, the preponderance of the evidence does not fairly and reasonably support the assessment of compensation for Timothy Brown's care for his daughter.

The parties agreed on present value net discount rates of 1% for future medical costs and 2% for future non-medical costs, a \$117,053.00 offset if 20 U.S.C. § 1401 et seq. applies, and a 7.06% TRICare reduction of future medical costs. The Court

finds that Melody falls within the coverage of 20 U.S.C. § 1401 et seq. Accordingly, the preponderance of the evidence fairly and reasonably supports the total award of \$6,468,752.17 in compensation for Melody's future medical, health, and attendant care. (See Ex. A, Future Cost Calculations.)

IV. Conclusion

For the reasons set forth in this opinion, the Court finds that Plaintiffs have proven that Defendant's violation of the standard of care proximately caused Plaintiffs' injuries. The Court finds the following sums a reasonably certain assessment of Melody Brown's damages: \$1,115,685.00 lost earning capacity; \$2,450,000.00 physical impairment, disfigurement, and pain and suffering; \$3,650,000.00 mental impairment, lost capacity for enjoyment of life, and mental pain and suffering; \$6,468,752.17 future medical, health, and attendant care costs adjusted for present value and reduced to reflect Melody's TRICare benefits and the requirements of 20 U.S.C. § 1401 et seq.. In addition the Court finds \$6,211.00 to be a reasonably certain assessment of Timothy Brown's past expenses incurred in caring for his daughter. Accordingly, the Court AWARDS \$13,690,648.17 in favor of Plaintiffs.

So ORDERED this 31st day of March, 2007.

/s/ JON P. McALLA
UNITED STATES DISTRICT JUDGE